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HUMAN CAPITAL INNOVATION: DESIGNING HRBP COMPETENCY MODELS FOR CHINESE INTELLIGENT MANUFACTURING IN THE DIGITAL ERA

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Abstract: The advent of the digital economy has ushered in a new era of intelligent and agile management, driven by rapid development and extensive technological penetration. Intelligent manufacturing, at the forefront of China's fourth industrial revolution, leverages advanced technologies like cloud computing, the Internet of Things, and big data to enable data-driven decision-making and end-to-end product development within interconnected supply chains. In this transformative landscape, traditional human resource management models in manufacturing enterprises are facing significant challenges.

The digital economy era has disrupted traditional boundaries and organizational structures, emphasizing the digitization of work processes and the need for real-time precision. As intelligent manufacturing systems rely on data-driven workflows and intelligent technologies to enhance R&D, production, and operations, the role of basic workers is diminishing, leading to internal restructuring within enterprises. Consequently, meeting the evolving talent demands of the digital economy is a pressing concern.

This abstract delves into the impact of the digital economy on human resource management, particularly within intelligent manufacturing enterprises in China. It highlights the need to redefine talent standards for the digital age and emphasizes the urgency of accumulating new digital human capital. The challenges and opportunities presented by this evolving landscape require innovative approaches to human resource management.

Keywords: Digital economy, intelligent manufacturing, human resource management, talent standards, digital human capital.

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Introduction

The digital economy is characterized by rapid development, extensive penetration, and the coexistence of uncertainty and sustainability, driving the era of intelligent and even agile management forward [1]. As the driving force behind China's fourth industrial revolution, intelligent manufacturing integrates various modern information technologies such as cloud computing, the Internet of Things, and big data. Utilizing data-driven decision-making and execution capabilities in advanced manufacturing systems enables the interconnection of the entire supply chain and linear development of products from ideation to marketization. In this context, the traditional human resource management model has been significantly impacted in manufacturing enterprises. The drawbacks have become increasingly prominent, making it particularly necessary to re-evaluate talent standards in the digital era and accelerate the accumulation of new digital human capital [2]. The impact of the digital economy era on enterprise human resource management primarily lies in transcending traditional geographical and organizational boundaries, the increasing informatization and digitization of work modes, and a heightened emphasis on timeliness and accuracy in work [3]. Additionally, as an intelligent manufacturing system with digitalization at its core, data-driven processes and workflows as its foundation, and the use of intelligent technologies to address bottlenecks in R&D, production, and operations management, automated machines have replaced most basic workers while enterprises have undergone significant internal restructuring to meet new talent demands. Therefore, in the prevailing digital economy, how to innovate human resource management within intelligent manufacturing enterprises will be a challenge faced by many such enterprises in China.

Through extensive research, this paper has discovered that in order to adapt to the digital economy era and enhance their self-innovation capabilities, numerous intelligent manufacturing companies in China are requiring their internal human resource managers to adopt a diversified development approach, with many now experimenting with the HRBP (Human Resource Business Partners) strategic model.

This model is characterized by the high integration of professional and business quality, where human resource management gradually shifts from traditional transactional management to a human resource business partner model with customer value as the core concept. The model necessitates the involvement of human resources managers in the strategic planning of the business department, leveraging their professional acumen to provide strategic direction for the department. In China, numerous high-tech enterprises and large Internet conglomerates such as Alibaba, Huawei, and Tencent have implemented the HRBP model in their early stages with significant success [4]. After practice, the author discovered that despite the transformation of many intelligent manufacturing enterprises' human resource management systems into a "Three-pillar" model, HRBP work remains challenging to advance, and existing HRBP personnel struggle to realize their full potential in the role. The primary reason is the scarcity of exceptional HRBP talents, the enterprise's inadequate proficiency in applying HRBP, and its failure to accurately align its positioning within organizational management. Consequently, identifying qualified HRBP candidates has become an urgent challenge for intelligent manufacturing enterprises.

In summary, the study of HRBP competency in intelligent manufacturing enterprises is crucial for empowering their development in the digital economy era. Although there has been a certain amount of research on HRBP competency and competency models in China, the study of talent competencies in intelligent manufacturing enterprises, particularly the HRBP competency model, is somewhat lacking. In light of the exigency of reality and the theoretical gap, this paper employs empirical research methods such as job analysis, behavioral event interviews,

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and questionnaire surveys to construct a highly practical and realistic HRBP competency model for intelligent manufacturing enterprises based on existing theoretical research and practical applications. The competency model with significant implications partially compensates for deficiencies in similar studies.

1. Literature Review

2.1. Definition of HRBP

Table 1: HRBP Six Competency Domains.

Six Competency Domains	Comment
Credible Activist	Proficient in resolving employee issues and consistently fosters employee motivation by establishing a positive work environment and opportunities for socialization.
Capability Builder	Gain trust and build influence by achieving measurable results while fostering employee growth by establishing clear objectives.
Strategic Positioner	Participate in the formulation of business strategies, break down strategies into subcategories, and enhance strategy implementation.
Change Champion	Help employees comprehend the change process and effectively break down objectives to enhance employee acceptance of relevant policy changes and facilitate implementation monitoring.
Human Resource Innovator and Integrator	Innovate the systematic process of human resources, integrate various resources, effectively screen talents, formulate comprehensive training plans, and drive optimal performance.
Technology Proponent	Use emerging technologies to enhance work methods, adeptly utilize diverse channels and resources for knowledge acquisition, actively advocate novel models and technologies, and avoid passivity.

HRBP was initially proposed by Professor Dave Ulrich from the University of Michigan in a 1997 publication, where he reimagined the traditional human resource management department as a "troika" model consisting of HRBP, HRCOE (Human Resource Center of Expertise), and HRSSC (Human Resource Shared Service Centre). This troika works collaboratively to execute all aspects of enterprise human resource management and ultimately enhance organizational efficiency [5]. His team concurred that an HRBP is a mid-to-high-level human resources management professional dispatched by the company to various business departments to assist departmental managers in handling human resourcesrelated tasks collaboratively. The task encompasses recruitment, team building organization, performance appraisal management, human resource development, and other related duties [6]. HRBP is accountable for timely business consultation while any unresolved issues are escalated to HRCOE. Experts then develop tailored solutions based on the specific problem at hand, as well as policies and regulations aimed at enhancing human resources. HRSSC is primarily accountable for executing transactional tasks related to

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human resource management processes [7]. Based on current practices in China and recent data analysis, HRBP can significantly enhance employee work efficiency for various business departments. It facilitates more convenient and effective communication with employees while providing centralized and standardized services. Additionally, it reduces enterprise management costs to a large extent and promotes the implementation and promotion of human resources management systems to a certain extent [8-9].

Professor Ulrich's team has conducted research on the competencies of human resource managers for 30 years, utilizing comprehensive research methods such as the behavioral event interview method, 360degree measurement method, and questionnaire survey method. The study encompasses a sample size of 3,000 and 5,000 enterprises. In the later stage of his study, the "HRBP Six Competency Domains" were proposed as a result of comprehensive research on HRBP role positioning and competency dimensions [10]. The detailed information is presented in Table 1.

2.2. Definition of competence

In 1973, McClelland introduced the fundamental concept of "competence", which refers to the overall quality of individuals who can effectively distinguish different performance levels in a specific job position and organizational environment [11]. It is important to note that a significant distinction exists between workers and general employees. In essence, McClelland's research posits that exceptional employee performance is attributable to their specific behaviors, knowledge, and skills; these personal attributes and conditions impacting job performance are referred to as competencies. Spencer's concept of competency pertains to various potential fundamental qualities inherent in individuals with a close causal relationship with the reference standard [12]. It represents the most profound and enduring aspect of an individual's basic character. They are closely interrelated and can serve as a valuable reference for enterprises to comprehend their anticipated or actual behavioral patterns and performance. However, despite numerous attempts by scholars to define competency, the academic community has yet to reach a consensus on its meaning. According to the research definitions of numerous scholars, this article adopts the Spencer couple's concept of competence as its definition, which refers to a person's potential personal characteristics, including knowledge, skills, and abilities required for work. Competence distinguishes between excellent and ordinary performance and can be measured and evaluated through research.

2.3. Competency model and construction method

In academia, the classic conceptual models of competency include the iceberg model, the onion model, and the competency dictionary [13]. This paper describes the extracted competency factors by referencing relevant definitions in the competency dictionary. Currently, the technical methods commonly utilizes for constructing competency models include Direct Observation, Job Description Analysis, Functional Job Analysis, Key Event Identification, Behavioral Event Interviewing, Expert Group Discussion, Questionnaire Surveying, Drawing on Existing Competency Models, or Expert System Databases [14]. The Behavioral Event Interview method, as summarized by Professor McClelland's extensive research, is widely recognized in academic circles as the most effective and commonly utilized approach [8]. This paper employs a job description analysis method, behavioral event interview technique, and Delphi method to initially extract competency qualities before determining final competencies through questionnaire surveys.

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Among the current studies on HRBP competency, two scholars, Boselie and Paauwe (2005), conducted in-depth questionnaire surveys on a large number of personnel practitioners and non-personnel practitioners in Europe [15]. The survey indicated that personal credibility and HR professionalism are crucial qualities for enterprises to possess when carrying out human resources work. Additionally, possessing strong business operation knowledge can bring added value to the work of human resources business partners. Lambert (2009) also emphasized in the enterprise research forum that HRBP must possess a wealth of business operational knowledge to deliver high-quality human resource management services to departmental managers [16]. Gerpott (2015) discussed the limitations of the business partner model and explored how organizational participants can restructure human resource management-related work to enhance diversity in human resource management [17]. He holds the belief that research based on HRBP's shortcomings can further enhance its strengths, mitigate weaknesses, and improve overall competence. McCracken et al.'s (2017) analysis led to the proposal of a life cycle model for HRBP, which highlights the dynamic and complex nature of HRBP competencies across different organizations and aspects thereof [7]. These competencies are contingent upon organizational culture as well as key stakeholders' skills and capabilities in partnership.

The aforementioned studies are all based on the capitalist market in developed countries. Representative research on China's socialist market economic system includes Ge Minglei (2015) emphasized in his case analysis that HRBP should possess strong business acumen, professional HR technical skills, cultural knowledge, and effective management abilities [18]. Liu Songbo, Pei Shanshan, and Liang Shuang (2016) conducted an investigation into the IT, Internet, software, and other fields to address prominent issues in HRBP positions within my country [19]. Through this research, they developed a competency model with a high degree of fit. Ultimately, they identified four key dimensions: "business acumen," "HR professionalism," "interpersonal communication," and "business service awareness." Jing Quanzhong and Sun Xiaoyan (2017) concluded that the quality of HRBP should encompass business acumen, human resources expertise, service orientation, and operational management proficiency [20]. These four dimensions align with Liu Songbo, Pei Shanshan, and Liang Shuang's "four-dimensional" framework. Wang Hui and Yang Ruige (2017) have pointed out that the dominant competencies of HRBP are theoretical thinking and professional skills required in the process of engaging in enterprise HRBP work. The main hidden competencies include self-awareness, job role positioning, motivation, trait description, etc [13]. It is proposed that invisible quality is the key to distinguish excellent performance employees from mediocre ones. Huang Xiaoxiao (2018) developed an HRBP competency model for the Internet enterprise software R&D department, consisting of 25 competency indicators and five dimensions of competency characteristics [14]. The five dimensions include self-efficacy, leadership, interpersonal communication, personal characteristics, and basic knowledge. Wang Lele and Cao Wei (2020) have applied iterative thinking to enhance the competence of HR practitioners for the first time [21]. As iterative thinking emphasizes the rapid response to external demand feedback, it urgently requires HR practitioners to continuously update themselves in actual work, adapting to the latest methods, thinking, and knowledge in order to cope with rapid changes in the external environment. This perspective places higher demands on learning ability and responsiveness of curriculum. Yuan Yuan and Li Jie (2020) have constructed an enterprise HRBP talent competency model by integrating practical experience from relevant enterprises [22]. This model includes six primary indicators of professional knowledge, personal ability, professional

ability, strategic contribution, professional quality, and internal drive, as well as 30 corresponding secondary indicators.

To summarize, research on the competency of human resource partners in developed countries has a longer history and more mature and classic studies. However, the findings from these countries are relatively outdated, with few recent theoretical or practical investigations into human resource management competency. Meanwhile, developed countries have not produced any particularly innovative or groundbreaking research results in the field of HRBP competency, with recent studies building upon previous findings. On the contrary, China has only started to popularize and implement the "Three-pillar" model in the past decade. Although research on HRBP competency is still in its exploratory and developmental stage, some experts and scholars have combined classic research findings from developed countries with various issues faced by Chinese enterprises to explore and extract many HRBP competencies and models that possess distinct Chinese characteristics.

2. Research Design

3.1. Job Analysis

In order to explore the composition of competency elements for HRBP positions, it is essential to clarify job responsibilities and requirements while conducting research and empirical analysis on closely related departments. Job analysis serves as the foundation for competency analysis, with qualitative and quantitative descriptions in job descriptions providing guidance for talent recruitment and selection [2325]. In order to enhance the credibility of research data, this paper has selected enterprises from the National Intelligent Manufacturing Demonstration Pilot Project issued by the China Ministry of Industry and Information Technology as samples. The Ministry of Industry and Information Technology released a total of 306 intelligent manufacturing demonstration enterprises between 2015 and 2018. This paper focuses on 80 intelligent manufacturing enterprises that have adopted the "three pillars" human resource management model as research subjects. We extracts basic information, job responsibilities, and job requirements related to HRBP positions from online recruitment of these companies and identifies 16 fundamental competencies for HRBP staff in intelligent manufacturing companies: Human Resources Expertise and Skills, Interpersonal Communication Skills, Affinity, Adaptability, Problem-solving Ability, Responsibility, Team-work Ability, Service Awareness, Confidentiality, Strong Pressure Resistance, Youthful Mindset, High loyalty, Corporate Culture Construction, Resource Integration Capability, Talent Cultivation Ability, Organization and Coordination Ability.

3.2. Behavioural Event Interview

3.2.1. Interview Sample

This paper utilizes behavioral event interviews, ten intelligent manufacturing companies implementing the "Three-pillar" human resource management model were selected as research subjects. 75 HRBP practitioners, department leaders, company executives, and other colleagues related to HRBP work were interviewed to conduct multidimensional research on the specific working conditions of HRBP positions and obtain authentic and effective first-hand information. Among the interviewees, 25 are HRBP practitioners, while the remaining 50 comprise 10 HRDs, 12 company executives, and 28 department leaders or related colleagues.

3.2.2. Interview Outline

According to the STAR principle, which is the fundamental principle of the behavioral event interview method, this paper requires each respondent to clearly articulate critical examples of HRBP in their work environment,

including specific details about when and where these events occurred, HRBP's responsibilities during those events, measures taken by HRBP to address them, and ultimately how these actions impacted outcomes [26-28]. The interview outline mainly includes three parts:

(1) The first part is to understand the basic information of the interviewees before the interview officially begins, which is filled in by the interviewers. The specific information includes respondents' gender, age, educational background, working years, and position in the company;

(2) The second part involves inviting HRBP practitioners from intelligent manufacturing enterprises to elaborate on 3-5 essential job responsibilities in their daily work, supported by practical examples that are contextualized based on the specific situation, task, action, and result of each event;

(3) The third part involves soliciting input from the department leaders, company leaders, and other colleagues related to HRBP work to list and describe 1-3 events in daily work with HRBP, according to the situation, task, action, and result of the event.

In the interview process, it is important to establish a comfortable and equitable communication environment for candidates while also ensuring accurate documentation of interview content to facilitate analysis of results.

3.2.3. Interview Results

The basic situation of the interviewees is as follows: 31 males and 44 females; most of the HRBP practitioners are females; only 19 interviewees are under 25 years old and over 35 years old; the remaining 56 respondents ranged in age from 25 to 35; only 11 interviewees possess a master's degree or higher, 15 interviewees holding a college degree, and 49 interviewees with a bachelor's degree; the working years of the respondents are concentrated in 5-10 years, and 19 of the 25 HRBP practitioners have less than five years of working years. After conducting all the interviews, we gathered and analyzed the interview recordings and written records to extract critical responsibilities of the HRBP position from event examples. Through the revision of the competency dictionary, relevant materials, and network search, this paper thoroughly examined the language descriptions of respondents. Competency entries for HRBP positions in intelligent manufacturing enterprises were extracted and discussed with human resource experts and colleagues in each enterprise's COE to determine the final entries.

Based on the 16 competencies identified through job analysis, similar factors have been integrated with the competency entries derived from this interview. For instance, the "flexibility" cited by numerous interviewees resembles the aforementioned "adaptability." According to the relevant information, "adaptability" is subsumed under "flexibility," thus rendering "flexibility" as the ultimate competency. Following integration, nine new competencies were extracted from the interview research: Industry Business Knowledge, Business Insight, Business Understanding, Initiative, Persuasion, Creative Thinking, Learning Ability, Legal Knowledge, Change Management Capability.

3.3. Questionnaire Survey Research

3.3.1. Questionnaire Design

Table 2: Competency Number and Description.

No.	Competency Quality	Behavior Description
1	Human Resources	Master the professional knowledge and skills of human resources, possess strong professional comprehension and

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	Expertise and Skills	control, and demonstrate exceptional sensitivity to the evolving dynamics within the field.
2	Interpersonal Communication Skills	Good at articulation, attentive listening, adept at networking and communication.
3	Affinity	Good at empathizing with others, exhibiting a gentle, compassionate and patient demeanor.
4	Flexibility	Proficient in utilizing diverse methodologies and approaches to efficiently resolve issues.
5	Problem-solving Ability	The ability to swiftly and accurately identify the root cause of a problem and effectively resolve it.
6	Responsibility	Reaffirm the significance of one's contribution to the organization and align oneself with the attainment of its objectives as personal goals.
7	Team-work Ability	Unite with colleagues, complement each other's strengths, and closely collaborate to accomplish work tasks.
8	Service Awareness	Prioritize the needs of employees and strive to effectively address any issues they may encounter.
9	Confidentiality	Protect the confidentiality of internal information and personal data of employees at all times.
10	Strong Pressure Resistance	When faced with challenges, I possess a resilient spirit and unwavering determination to persevere without surrendering.
11	Youthful Mindset	Be capable of comprehending young employees and maintaining high levels of energy consistently.
12	High Loyalty	Demonstrate a strong sense of allegiance to your employing organization and strive for excellence in your performance.
13	Corporate Culture Construction	Refine the enterprise's concept, system, behavior and material culture to enhance its professional image.
14	Resource Integration Capability	Able to effectively organize resources at a macro level, in order to enhance their value and promote development, while striving to optimize resource utilization efficiency.
15	Talent Cultivation Ability	Demonstrate a willingness and inclination to develop others, consistently recognize their potential and adaptability, and facilitate their learning and growth.

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16	Organization and Coordination Capacity	Good at effectively coordinating team member relationships and allocating resources.
17	Industry Business Knowledge	Master a comprehensive understanding of industry and business knowledge.
18	Business Insight	Possess business insight to support the business unit to develop business.
19	Business Understanding	Gain a comprehensive understanding of the primary operations and core competencies of the business department, and develop tailored human resource solutions to address any pain points within the organization.
20	Initiative	Proactively advocate for new models and technologies, rather than being passive.
21	Persuasion	Improved ability to effectively persuade team members to adapt seamlessly to significant changes within the company.
22	Creative Thinking	Unconstrained by prior experience, continuously enhance operational methodologies in response to current circumstances, and more effectively adapt to the demands of new developments.
23	Learning Ability	Good at utilizing diverse channels and resources to acquire knowledge, attain a certain level of mastery in new knowledge acquisition, and adept at synthesizing experiences.
24	Legal Knowledge	Gain a comprehensive understanding of the legal, regulatory and policy frameworks pertaining to human resources.
25	Change Management Capabilities	Continuously adapt to changes in the needs of business departments, improve organizational structure or cultivate talent pools to support organizational transformation.

Through the methods mentioned above, 25 competencies have been identified. The subsequent step involves conducting questionnaire surveys to gain insights into the expectations of multi-level employees in intelligent manufacturing companies for HRBP positions by further amalgamating HRBP's practical experience and existing problems. At the same time, the results of the questionnaire survey can further refine the 25 competencies that have been extracted. The questionnaire design is divided into the following three parts:

(1) The first section aligns with the content covered in Part One of our interview outline;

(2) The second part constitutes the core of the questionnaire, wherein respondents are required to evaluate the significance of 25 competency factors based on their comprehension of HRBP duties. This paper aims to provide behavioral descriptions that accurately reflect the HRBP competency of intelligent manufacturing enterprises, as repeatedly mentioned by interviewees during behavioral event interviews. By consulting the competency dictionary

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and other methods, we have correctly interpreted the 25 competency factors and provided appropriate explanations for each. The definition, description, and numbering are presented in Table 2. The scoring rules utilize a 5-point scale method, which categorizes competence into five distinct levels of importance: '5 points' for very important, '4 points' for more important, '3 points' for medium, '2 points' for less important, and '1 point' for very unimportant [29];

(3) The third part is to ask the respondents to answer: What role does HRBP play most significantly in your mind? This question option is derived from Ulrich's " HRBP Six Competency Domains. " Given the potential for errors in utilizing empirical findings to classify competency qualities and divide dimensions, this paper adheres to the scientific principle of model construction by adopting the established "HRBP Six Competency Domains" as the six dimensions of our model. We then determine the specific weight of each dimension within our constructed model.

3.3.2. Statistical Analysis of Questionnaire

This questionnaire adopts a combination of online and offline distributing forms. **Online**. It is made through the Questionnaire Star platform, and a link is generated for the author to distribute. **Offline**. HRD, and HRBP, an intelligent manufacturing company, assist the author in distributing and collecting. The time for filling out the questionnaire is October 2022. In this survey, a total of 300 questionnaires were distributed to HRBP practitioners, department leaders, company executives, and other colleagues related to HRBP work from 30 intelligent manufacturing companies (excluding the ten companies participating in the behavioral event interview research) who have adopted the "Three-pillar" human resource management model. A total of 277 valid questionnaires were recovered with an effective rate of 92%. 68.52% of the survey respondents were aged between 25 and 35, while only 15.56% were over the age of 35, indicating that employees in intelligent manufacturing companies tend to be relatively young, which is consistent with anecdotal evidence gathered from interviews. Most survey respondents hold undergraduate degrees, with a small proportion holding master's degrees. This indicates that the respondents possess a relatively high level of education and are capable of making clear and accurate judgments regarding the questionnaire contents. Among the investigators, there are 72 HRBP practitioners in intelligent manufacturing enterprises, 38 department leaders, 36 company leaders, and 131 other colleagues related to HRBP work. They can evaluate the HRBP post competencies of intelligent manufacturing enterprises from various aspects.

3. Results

4.1. HRBP competency factor refinement

4.1.1. Bartlett's Test of Sphericity and KMO Test

After collecting and summarizing questionnaires, it is necessary to conduct an overall validity test on the questionnaire results to determine their suitability for factor analysis [30]. We utilizes the KMO Test and Bartlett's Test of Sphericity for assessment. In Bartlett's Test of Sphericity, if $P<0.05$, it indicates that the data are distributed spherically, and each variable is independent to a certain extent. The KMO statistic ranges from 0 to 1, with higher values indicating greater suitability for factor analysis, as noted by scholar Kaiser [31]. Table 3 shows the results of questionnaire data testing: the final Bartlett's Test of Sphericity result is $P=0.00<0.05$, and the final KMO test result is $0.779>0.7$. Therefore, a clear conclusion can be drawn that the questionnaire feedback data follow a normal distribution and are suitable for subsequent factor analysis.

Table 3: KMO and Bartlett’s Test Results.

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KMO Measure of Sampling Adequacy		0.779
Bartlett's Test for Sphericity	Approx. Chi-Square	400.683
	df	120
	P	0.000

4.1.2. Competency Factor Extraction

We employ the Principal Component Analysis (PCA) method to extract factors from survey data. The variance maximization rotation was conducted without constraining the number of factors (eigenvalue>1), and a rotated component matrix was obtained, as presented in Table 4.

Table 4: The Component Matrix after Rotation.

Factor	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
03	0.926	-0.070	0.035	-0.110	-0.163	-0.057	-0.062
10	0.891	-0.069	0.056	-0.086	-0.275	0.094	-0.096
18	0.767	0.171	-0.226	0.050	0.162	-0.020	0.098
11	0.757	0.080	0.056	0.074	0.337	-0.059	0.070
13	0.639	-0.064	-0.182	-0.205	0.022	0.165	-0.228
14	0.617	0.170	-0.098	0.250	0.068	0.400	-0.356
04	0.462	0.258	0.129	-0.211	0.034	-0.384	-0.094
23	0.147	0.843	-.065	-0.007	-0.069	0.048	-0.053
21	0.069	0.767	-0.075	-0.092	-0.073	0.152	-0.054
25	-0.029	0.593	-0.377	0.115	0.443	0.206	-0.034
15	-0.196	0.498	0.473	0.004	-0.178	-0.221	0.130
17	0.054	-0.155	0.788	-0.061	0.138	0.098	-0.123
16	0.435	0.142	-0.603	0.101	0.018	0.222	-0.065
07	0.215	-0.112	-0.317	0.688	0.141	-0.247	0.018
20	-0.069	0.165	0.022	0.682	0.101	0.345	0.122
19	0.436	0.130	-0.054	-0.681	0.089	0.155	0.078
22	0.136	-0.103	0.151	-0.003	0.722	0.035	-0.084
01	0.547	0.071	0.120	-0.148	-0.635	-0.022	-0.063
12	0.223	-0.123	0.304	0.123	0.437	0.328	0.262
05	-0.058	-0.168	-0.094	0.088	-0.108	0.275	0.874
02	-0.183	0.254	0.005	-0.077	0.390	-0.210	0.606
08	0.045	0.196	-0.001	-0.106	0.061	0.396	0.140
24	0.030	-0.103	0.090	0.122	0.109	0.099	0.093
09	0.166	-0.152	-0.055	0.247	0.007	0.088	0.053
06	0.343	0.164	0.344	-0.305	-0.058	0.298	-0.223

Table 5: Competency Dimensions and Factor Classification.

Dimension	Competency Factor

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I Credible Activist	I(02)Interpersonal Communication Skills I(05)Problem-solving Ability I(11)Youthful Mindset
II Capability Builder	II(16)Organization and Coordination Capacity II(07)Team-work Ability II(15)Talent Cultivation Ability
III Strategic Positioner	III(17)Industry Business Knowledge III(18)Business Insight III(19)Business Understanding III(12)High Loyalty
IV Change Champion	IV(04)Flexibility IV(25)Change Management Capabilities IV(21)Persuasion
V Human Resource Innovator and Integrator	V(01)Human Resources Expertise and Skills V(22)Creative Thinking V(14)Resource Integration Capability V(13)Corporate Culture Construction V(03)Affinity
VI Technology Proponent	VI(10)Strong Pressure Resistance VI(23)Learning Ability VI(20)Initiative

By reviewing a large amount of relevant information, it is concluded that the currently commonly used factor selection standard is that the loading on a single factor must exceed 0.5. However, many scholars believe that 0.4 or more is sufficient [32]. According to the specific situation of the survey data, this paper determines that the reference standard for selecting the competency factor is: the load on a single factor exceeds 0.4. According to the data presented in Table 4, a thorough analysis was conducted, and it was ultimately determined that competencies numbered 08, 24, 09, and 06 – specifically "Service Awareness, "Legal Knowledge," "Confidentiality," and "Responsibility" – exhibit factor loadings below the threshold of 0.4 on a single factor. As such, these three competencies are deemed unsuitable for inclusion in the competency model and have been removed accordingly.

Based on the above analysis, the final 21 competencies were selected from the 25 competencies, combined with the HRBP Six Competency Domains proposed by David Ulrich, once again inviting human resource experts and colleagues from COE centers of various enterprises to divide into two groups for discussion. The discussion group members classified the 21 competency qualities by fully understanding the connotation of each dimension. We combine the classification results of the two groups and show the conclusions in Table 5.

4.2. HRBP competency model testing

4.2.1. Reliability analysis

Reliability analysis can examine the accuracy of quantitative data, particularly attitude scale questions, and assess the stability and consistency of such data [33]. In this paper, we test the questionnaire data and selected 21 final index

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variables for reliability analysis. The results are presented in Table 6, with an Alpha coefficient of 0.781>0.7 indicating good model reliability for the competency factor constructed from our final selection.

Table 6: Reliability Analysis Results.

Cronbach's Alpha	Cronbach's Alpha Based on The Standardized Terms	Number
0.781	0.723	21

4.2.2. Validity analysis

In addition to conducting reliability analysis, it is imperative to assess the structural validity of the initially constructed model by calculating correlation coefficients between each subscale and the entire model and among subscales[33]. The results of these calculations are presented in Table 7.

Table 7: Analysis Results of Structural Validity.

Total	Credible Activist	Capability Builder	Strategic Positioner	Change Champion	HR Innovator and Integrator	Technology Proponent
Credible Activist	1					
Capability Builder	0.197*	1				
Strategic Positioner	0.555**	0.066*	1			
Change Champion	0.258*	0.293*	0.228*	1		
HR Innovator and Integrator	0.416**	0.258*	0.658**	0.189*	1	
Technology Proponent	0.393**	0.267*	0.529**	0.377**	0.705**	1
** At level 0.01 (two-tailed), the correlation was significant. * At level 0.05 (two-tailed), the correlation was significant.						

As shown in Table 7, the degree of correlation among the subscales, while the "*" located in the upper right corner of each value represents the degree of correlation between the subscales and the entire model. The analysis results reveal that the correlation coefficient between subscales ranges from 0.066 to 0.705, indicating a certain level of independence among them. At the same time, all values are marked with "*" in the upper right corner, proving that each subscale can contribute to the whole. These two data fully demonstrate that the constructed model has good construct validity.

4.3. Dimensional weight of HRBP competency model

Table 8: Importance Statistics of HRBP Competency Model Dimensions.

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Options	Subtotal	Proportion	Modified Weight
A. Human Resources Innovator and Integrator	139	50.18%	50%
B. Credible Activist	56	20.22%	20%
C. Capability Builder	28	10.11%	10%
D. Strategic Positioner	27	9.75%	10%
E. Change Champion	14	5.05%	5%
F. Technology Proponent	13	4.69%	5%

According to the actual situation studied in this paper and the analysis of the specific practice of intelligent manufacturing enterprises, the weight of the same HRBP competency dimension for employees in different departments and positions will be different, i.e., the degree of importance will be different. We employ a subjective experience method to determine these weights by asking respondents, "what role does HRBP play most significantly in your mind?" through questionnaires. The respondents represent different levels, departments, and positions within intelligent manufacturing enterprises. The resulting data indicates HRBP competency model construction in such enterprises. Therefore, we utilizes the proportion of each option in this question as a weight number for each dimension (as shown in Table 8). To facilitate subsequent use of the data, we revised the weights assigned to each dimension.

4.4. Determination of HRBP competency model for intelligent manufacturing enterprises

Table 9: HRBP Competency Model of Intelligent Manufacturing Enterprises

Competency Dimension	Competency and Description	
A. Human Resource Innovator and Integrator (50%)	A1 Human Resources Expertise and Skills	Master the professional knowledge and skills of human resources, possess strong professional comprehension and control, and demonstrate exceptional sensitivity to the evolving dynamics within the field.
	A2 Creative Thinking	Unconstrained by prior experience, continuously enhance operational methodologies in response to current circumstances, and more effectively adapt to the demands of new developments.
	A3 Resource Integration Capability	Able to effectively organize resources at a macro level, in order to enhance their value and promote development, while striving to optimize resource utilization efficiency.
	A4 Corporate Culture Construction	Refine the enterprise's concept, system, behavior and material culture to enhance its professional image.

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	A5 Affinity	Good at empathizing with others, exhibiting a gentle, compassionate and patient demeanor.
B. Credible Activist (20%)	B1 Interpersonal Communication Skills	Good at articulation, attentive listening, adept at networking and communication.
	B2 Problem-solving Ability	The ability to swiftly and accurately identify the root cause of a problem and effectively resolve it.
	B3 Youthful Mindset	Be capable of comprehending young employees and maintaining high levels of energy consistently.
C. Capability Builder (10%)	C1 Organization and Coordination Capacity	Good at effectively coordinating team member relationships and allocating resources.
	C2 Team-work Ability	Unite with colleagues, complement each other's strengths, and closely collaborate to accomplish work tasks.
	C3 Talent Cultivation Ability	Demonstrate a willingness and inclination to develop others, consistently recognize their potential and adaptability, and facilitate their learning and growth.
D. Strategic Positioner (10%)	D1 Industry Business Knowledge	Master a comprehensive understanding of industry and business knowledge.
	D2 Business Insight	Possess business insight to support the business unit to develop business.
	D3 Business Understanding	Gain a comprehensive understanding of the primary operations and core competencies of the business department, and develop tailored human resource solutions to address any pain points within the organization.
	D4 High Loyalty	Demonstrate a strong sense of allegiance to your employing organization and strive for excellence in your performance.
E. Change Champion (5%)	E1 Flexibility	Proficient in utilizing diverse methodologies and approaches to efficiently resolve issues.
	E2 Change Management Capabilities	Continuously adapt to changes in the needs of business departments, improve organizational structure or cultivate talent pools to support organizational transformation.

	E3 Persuasion	Improved ability to effectively persuade team members to adapt seamlessly to significant changes within the company.
	E4 Strong Pressure Resistance	When faced with challenges, I possess a resilient spirit and unwavering determination to persevere without surrendering.
F. Technology Proponent (5%)	F1 Learning Ability	Good at utilizing diverse channels and resources to acquire knowledge, attain a certain level of mastery in new knowledge acquisition, and adept at synthesizing experiences.
	F2 Initiative	Proactively advocate for new models and technologies, rather than being passive.

Through the aforementioned analysis, we ultimately establishes a competency index consisting of 21 factors for the HRBP post competency model in intelligent manufacturing enterprises. According to David Ulrich's proposed HRBP Six Competency Domains, the factors are classified and sorted by weight ratio to propose a final model of HRBP job competency in intelligent manufacturing enterprises, as presented in Table 9. This model can be applied to specific practices such as talent selection, training, and performance management for HRBP positions within intelligent manufacturing enterprises.

4. Discussions

5.1. Conclusion

The digital economy era imposes higher demands on human resource management in intelligent manufacturing enterprises. Based on practical experience, we observe that during the transformation to a "Three-pillar" model, many intelligent manufacturing enterprises lack outstanding HRBP talents and fail to effectively apply HRBP skills, resulting in inaccurate positioning within organizational management and delayed progress in human resources transformation. Therefore, it is crucial to investigate the HRBP competency of intelligent manufacturing enterprises to facilitate their development in the digital economy era. We initially expounds on the connotation and development of HRBP, competency, and competency model. Subsequently, based on online recruitment information, relevant job descriptions from intelligent manufacturing enterprises are analyzed to extract 16 fundamental competency factors. Then, according to the STAR principle of the behavioral event interview method, the interview questionnaire is designed, and a total of 75 HRBP practitioners in intelligent manufacturing enterprises, department leaders, company leaders, and other colleagues related to HRBP work are selected to investigate the specific situation of HRBP positions from a multi-dimensional perspective. The interview competency entries were sorted out, and nine competency factors were extracted after integration. Thirdly, we utilizes a questionnaire survey to integrate further the actual situation of intelligent manufacturing enterprises and the practical experience of HRBP. The principal component analysis method is employed to refine the 25 competency factors extracted from the first two analyses, resulting in an initial construction of a competency model that encompasses 21 competency factors across six dimensions. Finally, the model undergoes reliability and validity analyses, revealing that the final competency model exhibits strong reliability and structural validity. The findings

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hold significant implications for human resource management practices in Chinese intelligent manufacturing enterprises. **5.2. Recommendations**

Based on the HRBP competency construction results of intelligent manufacturing enterprises mentioned above, we proposes the following measures to enhance HRBP competencies in such enterprises:

(1) Strengthen training in professional and technical abilities. In order to keep up with the development of the digital economy, intelligent manufacturing enterprises will opt for digital transformation. As a crucial link between the human resources department and business operations. HRBP is influenced by professional and business logic, requiring a certain level of industry-specific knowledge, technical expertise, and skills. Therefore, HRBP needs to pay attention to developing dual capabilities of professional and business capabilities, establish the awareness of internal customercentered, and avoid focusing on human resource management tools and methods while ignoring business issues. First of all, HRBP practitioners need to constantly improve the ability of the operation of the six modules of human resources, not to speak of the fact that the current work content is more flexible and changeable. It is more necessary to have a solid foundation and extensive knowledge of HRBP. Secondly, HRBP should proactively comprehend business processes rather than passively receive business information. In practical work, the foundation of HRBP lies in understanding the business. Only with a comprehensive grasp of the business can HRBP be qualified to participate in formulating departmental strategies and drive human resource transformation.

(2) Pay attention to learning and innovation ability training. Under the context of the digital economy, intelligent manufacturing enterprises have more diverse and sophisticated approaches to human resource management, which fosters innovation and comprehensiveness in this field. This calls for HR professionals with strong learning agility and innovative mindset to better serve daily operations and the long-term development of the enterprise. HRBP personnel should proactively adapt to the changes and challenges brought by the digital economy era and leverage digital and information technologies in all aspects of human resource management, including recruitment, training, performance assessment, and so on., to drive innovation and high-quality development in this field. This will further enhance human resource management's efficiency, convenience, and reliability. Therefore, HRBP personnel in intelligent manufacturing enterprises must possess the awareness and mindset of deeply integrating digital technology with human resource management. They should introduce advanced human resource management models into the enterprise and establish innovative mechanisms for developing human resources to enhance employees' professional level and work efficiency.

(3) Assisting enterprises in developing their digital transformation capabilities. In the era of the digital economy, intelligent manufacturing enterprises are confronted with increasingly complex and uncertain economic and market environments, where environmental dynamics inevitably exert a significant impact. Therefore, HRBP should focus on supporting enterprises in enhancing their digital dynamic capabilities, including Digital Perception Ability, Digital Capture Ability, Resource Integration and Reconstruction Ability, and Organizational Change Ability. Digital Perception Ability refers to the capacity to scan and explore the digital environment and investigate digital technology and market trends to identify and shape opportunities for digital transformation. Digital Capture Ability involves seizing integration opportunities and capturing knowledge resources that are useful for facilitating digital transformation. Resource Integration and Reconstruction Ability pertains to the effective allocation, distribution, and integration of digital resources. Organizational Change Ability refers to the capacity for reconstructing core and complementary resources through organizational change in order to achieve internal

transformation within an enterprise's daily operations. For instance, in the course of digital innovation and transformation for intelligent manufacturing enterprises, it is imperative to recruit CEOs, executives, and professionals with a digital background to facilitate their implementation of digital perception and innovation. In cases where the CEO lacks such expertise, they should engage senior executives and technical experts who possess proficiency in digital technology to devise a strategy for its development. Simultaneously, we must support enterprises in cultivating a cohort of technology research and development professionals who possess the adaptability to new manufacturing technologies and enhance the responsiveness of organizational resources.

5.3. Limitations and prospects

Due to various factors, this paper still has some limitations that require further investigation:

(1) The distribution of questionnaires is limited. Although this survey encompasses personnel at all levels related to HRBP positions in intelligent manufacturing enterprises, the small number of HRBP and leadership positions results in an inconsistent proportion of different survey respondents. Therefore, the model construction may focus on opinions put forward by ordinary employees.

(2) There are limitations in the data analysis process for constructing a competency model due to its complexity. This requires a substantial amount of up-to-date data and various data analysis tools to support it. This paper lacks the utilization of other data analysis methods for conducting multiple tests and corrections on the extracted factors.

(3) This paper does not conduct longitudinal research and dynamic analysis on the HRBP competency model of intelligent manufacturing enterprises. The "Three-pillars" of human resources constitute a systematic project, and strategic adjustments will be made in accordance with the developmental dynamics of the enterprise. The competency model presented in this paper is solely based on the investigation and research of the HRBP model within intelligent manufacturing enterprises and, therefore, only applicable as a data reference for companies operating within the same industry.

For the future works, based on the specific implementation of the "Three-pillars" human resource strategy in intelligent manufacturing enterprises, research methods can be further refined to enhance the scientific validity of questionnaires, expand the sample size and conduct a more comprehensive analysis. Meanwhile, it is possible to conduct hierarchical and diversified research on HRBP competency models in conjunction with the development of HRBP positions within intelligent manufacturing enterprises at different stages and business characteristics across various regions. This will result in a more targeted and practical HRBP competency model that aligns better with enterprise development needs. Furthermore, we can delve deeper into the specific application of the model and devise corresponding instructions or programs.

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